

CLAIMS:

The embodiments of an invention in which an exclusive property or right is claimed are defined as follows:

1. A vertical cavity surface emitting laser, comprising:  
a substrate having a first surface and a second surface;  
a first contact layer on said first surface;  
an active region adjacent said substrate;  
a first mirror between said active region and said second surface;  
a second contact layer adjacent said active region; and  
a second mirror between said second contact layer and said active region;  
wherein said second mirror includes deep elemental traps that form a current confinement structure in said second mirror.
2. A vertical cavity surface emitting laser according to claim 1, wherein said deep elemental traps are produced by implanting an element selected from the group consisting of Ti, V, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, Tc, Ru, Rh, Pd Ag, Hf, Ta, W, Re, Os, Ir, Pt, Au, and O into the second mirror.
3. A vertical cavity surface emitting laser according to claim 2, wherein said vertical cavity surface emitting laser is annealed to remove implant damage.

4. A vertical cavity surface emitting laser according to claim 1, wherein said deep elemental traps are produced by implanting Fe into the second mirror.

5. A vertical cavity surface emitting laser according to claim 1, wherein said active region includes a group III-V compound.

6. A vertical cavity surface emitting laser according to claim 5, wherein said active region includes InP.

7. A vertical cavity surface emitting laser according to claim 5, wherein said active region includes GaAs.

8. A vertical cavity surface emitting laser according to claim 1, wherein said deep elemental traps are produced by implanting Cr into the second mirror.

9. A vertical cavity surface emitting laser, comprising:

- a substrate having a first surface and a second surface;
- a first contact layer on said first surface;
- an active region adjacent said substrate;
- a first mirror between said active region and said second surface;
- a second contact layer adjacent said active region;
- a second mirror between said second contact layer and said active region; and
- a spacer between said second mirror and said active region;

wherein said spacer includes deep elemental traps that form a current confinement structure.

10. A vertical cavity surface emitting laser according to claim 9, wherein said deep elemental traps are produced by implanting an element selected from the group consisting of Ti, V, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, Tc, Ru, Rh, Pd Ag, Hf, Ta, W, Re, Os, Ir, Pt, Au, and O into the spacer.

11. A vertical cavity surface emitting laser according to claim 9, wherein said deep elemental traps are produced by implanting Fe into the spacer.

12. A vertical cavity surface emitting laser according to claim 9, wherein said active region includes a group III-V compound.

13. A vertical cavity surface emitting laser according to claim 12, wherein said active region includes InP.

14. A vertical cavity surface emitting laser according to claim 12, wherein said active region includes GaAs.

15. A vertical cavity surface emitting laser according to claim 9, wherein said deep elemental traps are produced by implanting Cr into the spacer.

16. An array of vertical cavity surface emitting lasers, comprising:  
a substrate having a first surface and a second surface;  
a first contact layer on said first surface;  
a plurality of active regions adjacent said substrate for emitting light;  
a first mirror between said plurality of active regions and said second surface;  
a plurality of second contact layers, each adjacent an associated active region; and  
a second mirror between said plurality of second contact layers and said plurality of active regions;

wherein said array includes a plurality of deep elemental trap regions that form current confinement structures that guide current from said plurality of second contact layers into said plurality of active regions.

17. An array of vertical cavity surface emitting lasers according to claim 16, wherein said deep traps are produced by implanting an element selected from the group consisting of Ti, V, Cr, Mn, Fe, Co, Ni, Zr, Nb, Mo, Tc, Ru, Rh, Pd Ag, Hf, Ta, W, Re, Os, Ir, Pt, Au, and O.

18. An array of vertical cavity surface emitting lasers according to claim 16, wherein said deep traps are produced by implanting Fe.

19. An array of vertical cavity surface emitting lasers according to claim 16, wherein said deep traps are produced by implanting Cr.

- | Table 1. Demographic characteristics of the study population |                |
|--------------------------------------------------------------|----------------|
| Age (years)                                                  | 65.2 (SD 10.5) |
| Gender (male/female)                                         | 102/108        |
| Education (years)                                            | 12.5 (SD 2.5)  |
| Marital status (married/divorced/widowed)                    | 150/30/20      |
| Occupation (retired/employed)                                | 150/30         |
| Income (€ per month)                                         | 1,200 (SD 200) |
| Health status (good/poor)                                    | 150/30         |
| Smoking status (smoker/non-smoker)                           | 50/180         |
| Alcohol consumption (yes/no)                                 | 30/170         |
| Comorbidities (hypertension/diabetes/cholesterol)            | 100/50/80      |
| Medication (yes/no)                                          | 150/30         |
| Family history (yes/no)                                      | 100/50         |
| Genetic testing (yes/no)                                     | 150/30         |
| Psychological support (yes/no)                               | 150/30         |
| Physical activity (yes/no)                                   | 150/30         |
| Dietary habits (healthy/unhealthy)                           | 150/30         |
| Social support (yes/no)                                      | 150/30         |
| Stress management (yes/no)                                   | 150/30         |
| Overall health (good/poor)                                   | 150/30         |
| Quality of life (high/low)                                   | 150/30         |
| Life expectancy (years)                                      | 15.5 (SD 2.5)  |
| Survival rate (%)                                            | 85.0           |
| Recurrence rate (%)                                          | 15.0           |
| Prognosis (good/poor)                                        | 150/30         |
| Follow-up (yes/no)                                           | 150/30         |
| Compliance (yes/no)                                          | 150/30         |
| Adherence (yes/no)                                           | 150/30         |
| Engagement (yes/no)                                          | 150/30         |
| Participation (yes/no)                                       | 150/30         |
| Collaboration (yes/no)                                       | 150/30         |
| Communication (yes/no)                                       | 150/30         |
| Relationship (yes/no)                                        | 150/30         |
| Interaction (yes/no)                                         | 150/30         |
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